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Grouping variables in language acquisition: Age groups and pretesting *

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ABSTRACT

Recent research in linguistic theory and language acquisition theory has progressed to the point where more detailed hypotheses can be made about the interaction of language learning and linguistic theory. These hypotheses can be used to make more precise predictions about prerequisite knowledge for learning a particular construction and the developmental sequences involved. Two recent proposals in the literature are discussed briefly (Chomsky 1981 and Roeper, in press), with their implications for acquisition research. A study of relative clauses is presented, in which an analysis based on linguistic pretesting allows correlations to be made between the development of relative clauses and the complementizer system which would not be possible if the data were analysed on the basis of age.

In language acquisition research, deciding on a means for grouping the subjects for analysis is always a problem, particularly when the constructions being examined are complex or when the children are older. Since grouping variables are assumed to be independently distributed from the test variables (Winer 1971), the grouping should be theoretically independent from the test results, and should serve to reveal the stages of development a child goes through. There are essentially two approaches which have been used in the past: grouping the subjects by age, and grouping the subjects according to some criterion which can be considered to be independently distributed from the within-subjects factors (repeated measures), such as overall error rate or a task-independent measure of linguistic development.

Age has always been somewhat suspect as a grouping variable for language acquisition, especially in the later stages. It is generally accepted that children learn at different rates and that different children may not learn the same construction at the same age. While some recent studies have discussed individual differences in acquisition and possible sources for variation (for example, see Ingram 1981), the bulk of cross-sectional studies must assume more or less homogeneous stages of development. The use of a particular grouping variable

should serve to increase that homogeneity as much as possible.

For younger children (below the age of three), Mean Length of Utterance (MLU) has been used as a criterion for development. MLU has been found to be a more consistent predictor of performance than age (DeVilliers and DeVilliers 1973). However, MLU ceases to be very useful after the age of three, when the child's utterances become more complex, and the length of utterance is no longer so closely tied with cognitive and linguistic development. Many studies of older children use age as a grouping variable, in six month or year increments. While chronological age classed in this way often is a significant grouping variable, providing interesting information on developmental stages, there can be problems with this approach. There are cases where age is not a very strong grouping variable, and sometimes it turns out to be insignificant. For example, Tavakolian (1977) and Flynn and Lust (1980) both report studies of relative clauses in which age was not a significant factor. Even if age is significant at the .05 level, it may be less significant than some other indicator of development such as grade or reading ability, especially with older children. This is really not surprising. Tests of older children tend to concentrate on specific constructions and subtle differences of interpretation or structure. These differences are not the sort of thing that are likely to be learned at a specific age, but probably depend crucially on the individual child's cognitive development and the type and quantity of the linguistic data he is exposed to. One might therefore expect that there will be

four-year-olds who do very well on a particular test while some five-year-olds do badly.

In addition, the use of age as a grouping variable may obscure developmental changes which are more obvious when a different criterion is used. For example, Phinney (1981a) discussed several stages in the development of a rule to interpret negation in complex sentences. When the data was analysed on the basis of age, it appeared only that children made fewer mistakes as they got older. Grouped on the basis of overall error rate, it was clear that there were several strategies which appeared during the course of development which indicated that the acquisition of the negation interpretation rule consisted in part of narrowing the domain of its application.

One way of getting around the problem of age is to establish an independent criterion for grouping the subjects. This can be done on various ways. If it is suspected that different strategies exist, then use of an overall error rate or other criterion unrelated to the within-subjects factors may prove fruitful. However, if a specific construction is being examined, linguistic theory may provide possible criteria in the form of knowledge that the child needs to know in order to understand the construction in question. The level of this knowledge can be determined by the use of pretests, which can then be used to group the subjects independently of their responses to the main tests. The results of such pretests can then be used as grouping variables in an analysis of variance design or as part of a

correlational study.

This approach is not new and is more common in studies of early language development. Often, Piagetian or similar cognitive development tasks are used as pretests to determine groupings (for example, see Corrigan 1978, 1979; Nicolich 1981). A correlative approach is less commonly used when the children are older or when complex syntactic constructions are being examined, and it is rare to find a study in which linguistic tasks are correlated (although DeVilliers and DeVilliers 1974 and Otsu 1981 are two examples).

Recently, there have been two proposals, one within linguistic theory and one within acquisition theory, which can serve as a basis for designing experimental pretests and correlational studies. Transformational grammar has always assumed that there is a universal linguistic component which serves as the basis for all grammars. That universal component is commonly called Core Grammar. The present version of the Revised Extended Standard Theory (Chomsky 1980, 1981) holds that certain aspects of Core Grammar are parameterized. That is, for any particular condition or constraint, there would be a limited set of options. One of these options would be the unmarked or default option, which would hold in any language unless evidence can be found which rules out that option. In that case, a different option would be selected, and the setting of the parameter would be marked.

For example, consider the use of subject-agreement, which has been discussed in the literature as a possible parameter (Chomsky 1979). There are a number or possible manifestations of subject-verb agreement; the verb may agree with its subject in person, number, case, gender, or noun class, to mention a few possibilities. However, not all of these agreement options are used in all languages; some languages use only a one or two, others use several. English, for example, uses only person (third person singular present tense); in the majority of cases, there is very little change in the verb for number. French uses person and number, and gender in the passé composé. Navaho does not use gender, but does require that verbs agree with their subjects in noun class. Presumably there would be a default option, which would be assumed unless there is evidence to the contrary; evidence would be needed to implement the other options. A particular constraint may be part of Core Grammar, but it may not appear to hold in all languages. If that is the case, it may be that one value of the constraint (either that it applies or it doesn't) is the default or unmarked case. The other value would then be marked, and must be evidenced in the available positive data from the language in question.

The unmarked or default value may be determined by the assumptions of the theory, or it may be determined on the basis of learnability. In other words, given two values of a parameter, one may be deducible on the basis of the linguistic data available to the child, and the other may not be deducible. In that case, the latter becomes the default value, and the

former value is said to be "marked", and must be set from the available evidence. (For various approaches to this problem, see Pustejovsky and Burke 1981).

This framework can be adapted for acquisition theory with a minimum or effort. In fact, the parameterized framework was originally proposed to serve as an input to the acquisition device. For a child learning a language, the initial hypothesis would correspond to the unmarked setting of the parameter. If the child does not hear the necessary data, the constraint will remain at the unmarked setting. The setting will be changed only if sufficient evidence is available to indicate that the unmarked setting is incorrect. If the child does hear the crucial data, he will be able to reset the parameter to the marked setting which is correct for the language. While this is obviously simplified, this model of language learning has the redeeming feature or requiring only positive data for altering grammatical hypotheses, in accordance with claims that have been made about language learnability (Baker 1979, Wexler and Culicover 1980).

The second proposal is that of a system of triggers for language acquisition proposed by Roeper (in press). In part, he proposed that certain aspects of the linguistic system are linked to deductive triggers, which can be loosely described as the necessary and sufficient data to instantiate a particular aspect of the linguistic system. For example, a child must at some point incorporate embedded sentences into his grammar, in the form or an internal S boundary. There are several possible triggers for such a structure, which include the [±Tense]

distinction, the use of a lexically filled complementizer, use of an embedded subject, and the use of two "main" verbs. All of these triggers can be logically deduced from the linguistic properties of embedded complements. Such triggers can be examined in pretesting, to be correlated with other data, or they can serve as the basis for primary research. Other kinds of triggers mentioned by Roeper, such as neurological and "hardwire" triggers, which are "stipulated in universal grammar" and provide "an elementary discovery procedure for the child", may not be logically determinable from linguistic properties, and so may be less accessible to empirical research. Cognitive triggers, the fourth type mentioned by Roeper, are of course subject to the types of correlative studies previously mentioned.

The parameterized model and the triggers framework are similar in certain respects. They both assume that language learning relies primarily on positive data, and that the linguistic theory should represent that in some way. Both are concerned with the interactions between prerequisite evidence and particular aspects of the linguistic system. However, they also differ in an important respect. As they presently stand, the parameterized model is a linguistic model, a part of linguistic theory which also has interesting implications for problems in language acquisition. The triggers framework is more a theory of acquisition, of the kinds of evidence necessary for instantiation of linguistic structures and can lead to more specific predictions about the developmental process.

Both of these proposals can serve as a basis for pretesting. If the construction being examined is dependent on a Core Grammar property or concerns a Core Grammar property itself, then the logical subject for pretesting would involve the crucial data necessary for setting the parameter. For example, if knowledge of particular aspects of subject-verb agreement is considered to be the crucial data for use of a particular constraint, then the child's awareness of agreement can be tested in conjunction with his knowledge of the constraint. The use of a framework which includes triggers can provide not only hypotheses about the course of development, but if the triggers have several levels, they can serve as an indication of the stage the child has reached in incorporating the relevant structures in his grammar.

These models can provide a rich source of potential pretests and correlational studies. For example, if the research concerns the use of a rule which is crucially dependent on particular structures, the obvious pretest would be to examine those prerequisite structures. For example, the correct interpetation of certain kinds of anaphora is dependent on having the correct syntactic structures. A useful pretest would be to examine the child's knowledge of those structures. since failure on a test of anaphora should not be then attributed to simply a lack of knowledge of the anaphora rules; it may in fact be due to a lack of knowledge of the correct syntactic structures.

I would like to briefly discuss the results of a study of relative clause interpretation, and compare the results of two analyses, one by age at six month intervals, and one based on two pretests. The sentences used are shown in (1) and (2).

1. a. The bear that jumped touched the turtle.
   b. The cow who ran kicked the lion.
2. a. The dog kissed the chicken that hopped.
   b. The horse hit the sheep who jumped.

The subjects were fifty children, ages 3;0 to 6;5, who were attending two day care centers in Agawam, Massachusetts. The pretests consisted of an imitation task in which the subjects were asked to repeat two-clause sentences with _that_ and _for_ complementizers. They were scored on their use of the complementizers and were assigned to one of four groups on the basis of a cluster analysis. Group I used only single clause sentences, and had a mean age of 3;7; Group II used two-clause sentences but no complementizers, and had a mean age of 4;9; Group III used only _that_ as a complementizer, and had a mean age of 5;0; and Group IV used both _that_ and _for_, and had a mean age of 5;2. Since subject relatives require the use of a complementizer, it is reasonable to assume that a child will not be able to correctly interpret relative clauses until he knows what a complementizer is. In addition, the comprehension of _that_ relatives should be correlated with the use of _that_ as a complementizer. This pretest can thus provide data on the prerequisite knowledge.

The relative clause test consisted of sixteen sentences, four tokens of each sentence type. The children were asked to act out the sentences using small plastic animals. Each child was familiarized with the names of the animals prior to the test. Each child was tested individually.

The standard coding for relative clause types was used (Sheldon 1972, Tavakolian 1977). The sentences in (1) are coded as SS, meaning that the relative clause is in the subject position and the gap in the relative clause is in the subject position. The sentences in (2) are coded as OS, meaning that the relative clause is in the object position, and the gap in the relative clause is in the subject position. Traditionally, SS relatives are the easiest for children, and OS relatives are the most difficult (Sheldon 1972, Tavakolian 1977).

Two ANOVAs were calculated, one using age in six-month increments as the grouping variable and one using the pretest groups as the grouping variable. When age was used, it was barely significant ($F(5,42) = 2.60$, $p = .04$). If MinF' is used rather than the standard F ratio, which treats items as a random factor to compensate for the problem of item as a fixed-effect (Clark 1973), age is not significant ($MinF'(5,51) = 2.98$, $p > .05$). Wnen the pretest groupings were used, Group was a highly significant factor ($F(3,44) = 5.27$, $p = .003$), even when the MinF' ratio is used ($MinF'(3,50) = 4.08$, $p < .025$). (1)

Insert Figure 1 about here

The results or the age-based analysis are shown in Figure 1. It is clear that the age-based analysis does not show a clear developmental picture. While in general, the older children get better on the OS relatives with age, the four-and-a-half and five-year-olds seem to get worse before they get better. There is no significant difference between the pronouns who and that. In addition, there is no way to determine why the children learn relative clauses when they do.

Insert Figure 2 about here

The results or the pretest-based analysis are shown in Figure 2. In this analysis, however, the information from the pretests can be used to provide further details about the developmental process. Group I would not be expected to comprehend OS relative clauses; they could not repeat more than single-clause sentences, and they did not use complementizers. Group IV has demonstrated that they know and use complementizers; therefore it is not surprising that they get the correct interpretations or both types of relative clauses. Group II, who do not use the complementizers that and for, do better than Group I but not better than chance($t(14) = 0.68$, $p > .05$), due to the high amount or variance in the responses. Group III, who use only that as a complementizer, only do better than chance on OS relatives with that ($t(8) = 2.31$, $p < .05$), but not on OS relatives with who. In other words, they do not seem to made generalizations about the COMP position. Thus, in this case, the use or a pretest provides an explanation for the development of children's ability to interpret relative clauses based on the

development of the complementizer system, while these changes were obscured by the analysis based on age.

The use of pretesting or correlative studies can serve two purposes. First, information about the child's existing linguistic knowledge can serve to eliminate possible hypotheses and strategies. Consider the problem of examining a constraint that is assumed to be a part of Core Grammar. If the data indicates that the child violates the constraint, no claims can be made about the Core Grammar status of the constraint without knowing anything about the child's linguistic development. For example, application of a constraint may be crucially dependent on the use of embedded S boundaries. If the child does not have embedded S boundaries in his grammar, it would be expected that he would violate the constraint. Without knowing what the status of S is in the child's grammar, one could not interpret an apparent violation of the constraint as an indication that the constraint is not present in the child's grammar.

Second, if the pretest indicates a sequence of development, it can be correlated with the results of the main test to provide a better picture of the acquisition process. In the case presented here, the pretest data indicated a gradual development of the complementation system, and this could then be correlated with the development of the comprehension of relative clauses.

Even when theoretical justification can be made for the use of pretesting to determine subject groupings for analysis and the use of correlative studies, a word of caution is in order. The

knowledge accessed in the pretesting should be determined to be crucially related to the structures examined in the main tests. Ideally, this determination should be made on the basis of linguistic theory and not on an ad hoc basis. Although this is often difficult given the theoretical analyses available, a detailed linguistic theory should lead to some predictions about prerequisite knowledge and order of acquisition. The use of pretesting can also serve as a further test for the proposed analysis. If suitable controls are observed, the significance of the pretest grouping can serve to support or falsify the linguistic analysis and the predictions derived from it.

Of course, this approach will not be useful in determining age-of-acquisition norms, but it is unlikely that there are genuine age norms for the acquisition of complex constructions, for which a correlative approach would be more useful. In addition, other non-linguistic factors, such as memory load, cognitive development, and task-related difficulties should be taken into account and controlled as much as possible, as these factors can interact with the linguistic factors. With the use of more detailed linguistic theories which consider problems of learnability as part of the guidelines for determining an analysis, and the use or models of acquisition like the theory of triggers discussed by Roeper (in press), it is important to integrate the study of the acquisition of complex constructions with previous linguistic knowledge, based on predictions derived from linguistic theory. The results will provide clearer pictures for acquisition theory and for linguistic theory.

FOOTNOTES

*A version or this paper was presented at the LSA annual meeting in San Antonio, December 1980. The author would like to thank Jill deVilliers and Tom Roeper for helpful comments on an earlier version or this paper. The research presented here was conducted as part or the author's doctoral dissertation.

1. One criticism of this discussion might be that the number of age groups (7) is larger than the number of pretest groups (4), which could arfect the significance of age as a factor. However, a similar analysis using one-year intervals was significant at the same level, p=.04.

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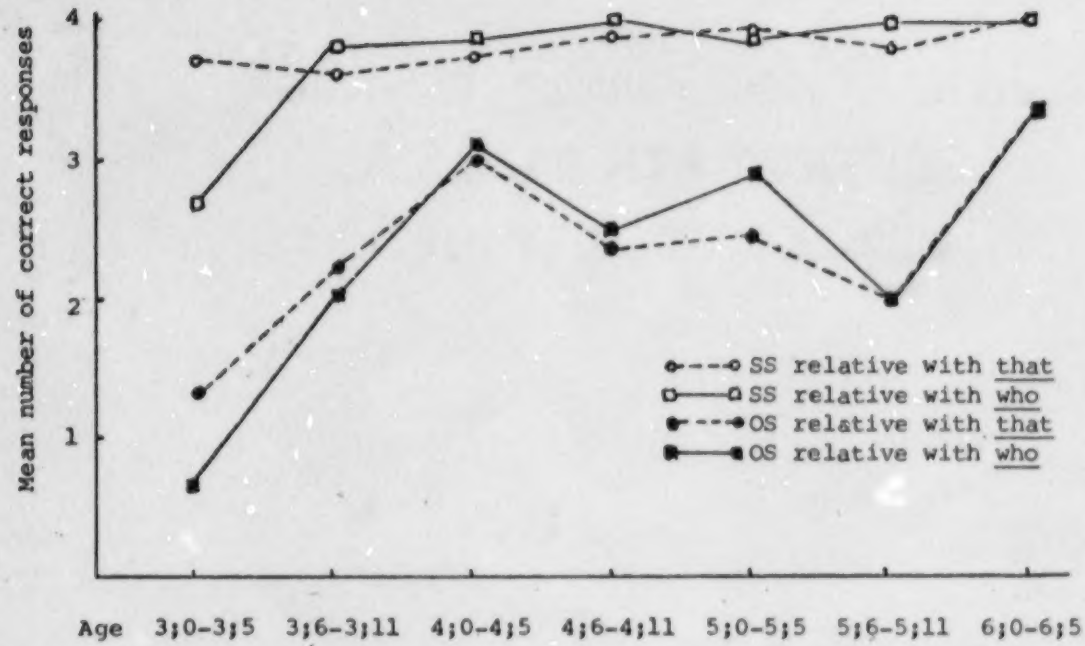

Figure 1

Mean number of correct responses to relative clause interpretation. Subjects grouped by age.

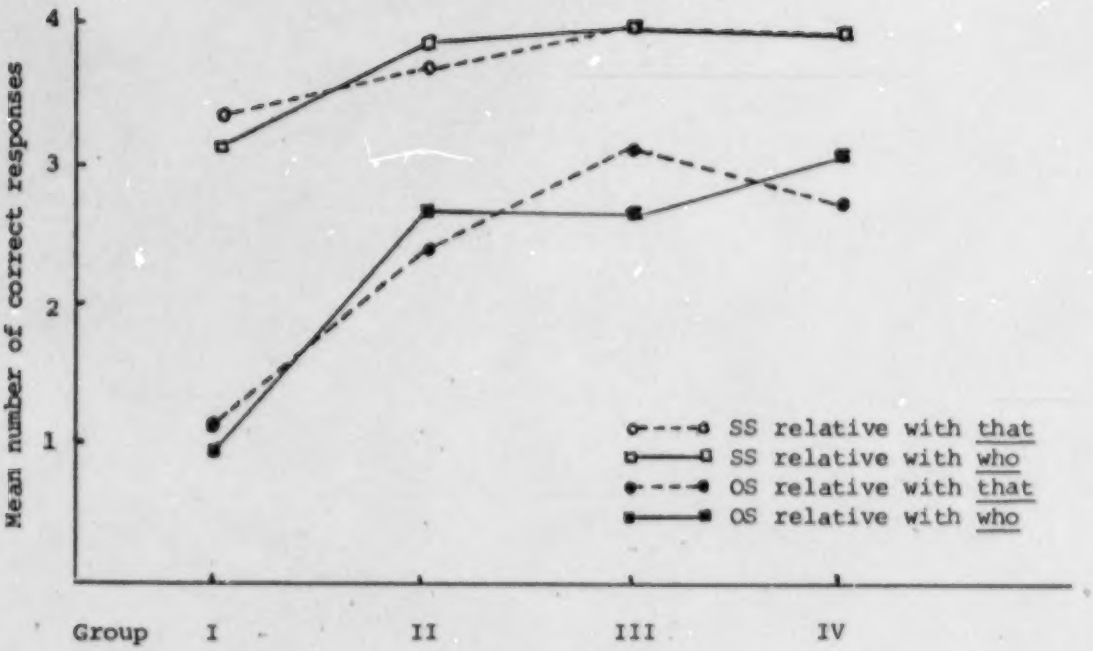

Figure 2

Mean number of correct responses to relative clause interpretation. Subjects group by pretest responses.